

## 9. Assessment of the Flathead Sole-Bering flounder Stock Complex in the Bering Sea and Aleutian Islands

Carey R. McGilliard, Dan Nichol, and Lyle Britt  
November 2019

### Executive Summary

#### Introduction

"Flathead sole" as currently managed by the North Pacific Fishery Management Council (NPFMC) in the Bering Sea and Aleutian Islands (BSAI) represents a two-species complex consisting of true flathead sole (*Hippoglossoides elassodon*) and its morphologically-similar congener Bering flounder (*H. robustus*). In 2012, the BSAI Groundfish Plan Team moved flathead sole to a biennial stock assessment schedule because it has been lightly exploited for a substantial period of time (BSAI Plan Team, 2012) and a full stock assessment report was produced in 2018. This year, a partial assessment is presented. In partial assessment years, an executive summary is presented to recommend harvest levels for the next two years, along with trends in catch and biomass. The single species projection model is run using parameter values from the accepted 2018 assessment model, together with updated catch information for 2018 and 2019, to predict stock status for flathead sole in 2020 and 2021 and to make ABC recommendations for those years. Please refer to last year's full stock assessment report for further information regarding the stock assessment model (McGilliard et al. 2018, available online at <https://www.afsc.noaa.gov/REFM/Docs/2018/BSAI/BSAIfathead.pdf>). A full stock assessment document with updated assessment and projection model results will be presented in next year's SAFE report.

#### Updated catch and projection

The most recent EBS Groundfish Survey was conducted in 2019. A preliminary examination of results from the survey indicates that survey biomass of flathead sole in the standard survey area increased from 484,890 t in 2018 to 592,257 t in 2019. Biomass of Bering flounder in the standard survey area decreased from 3,524 t in 2018 to 2,092 t in 2019, which is the lowest survey biomass recorded for Bering flounder in the EBS shelf survey's standard area. Survey biomass of Bering flounder in the Northern Bering Sea increased from 12,355 t in 2010 to 20,784 t in 2018, and then decreased slightly to 18,526 t in 2019.

Flathead sole is managed in Tier 3a. To run the projection model to predict ABC's for 2020 and 2021, estimates are required for the total catches in 2019-2021. The final catch for 2019 was estimated by adding the average catch between October 19 and December 31 over the years 2014-2018 to the current catch. The 2020 and 2021 catches were estimated as the average catch over the previous 5 years (2014-2018). Based on the updated projection model results, the recommended ABC's for 2020 and 2021 are listed in the table below. The new ABC recommendation and OFL for 2020 are slightly lower than those developed in 2018 using the 2018 full assessment model and projected 2018-2020 catches because the 2019 projected catch (15,043 t) is larger in this year's projections than in last year's projections (12,936 t).

Quantity	As estimated or <i>specified last year for:</i>		As estimated or <i>recommended this year for:</i>	
	2019	2020	2020*	2021*
<i>M</i> (natural mortality rate)	0.2	0.2	0.2	0.2
Tier	3a	3a	3a	3a
Projected total (3+) biomass (t)	673,718	686,431	684,768	692,915
Projected female spawning biomass (t)	153,203	155,032	154,195	160,864
<i>B</i> <sub>100%</sub>	212,060	212,060	212,060	212,060
<i>B</i> <sub>40%</sub>	84,824	84,824	84,824	84,824
<i>B</i> <sub>35%</sub>	74,221	74,221	74,221	74,221
<i>F</i> <sub>OFL</sub>	0.47	0.47	0.47	0.47
<i>maxF</i> <sub>ABC</sub>	0.38	0.38	0.38	0.38
<i>F</i> <sub>ABC</sub>	0.38	0.38	0.38	0.38
OFL (t)	80,918	83,190	82,810	86,432
maxABC (t)	66,625	68,448	68,134	71,079
ABC (t)	66,625	68,448	68,134	71,079
Status	As determined <i>last year</i> for:		As determined <i>this year</i> for:	
	2017	2018	2018	2019
Overfishing	no	n/a	no	n/a
Overfished	n/a	no	n/a	no
Approaching overfished	n/a	no	n/a	no

\* Projections are based on estimated catches of 15,043 t used in place of maximum permissible ABC for 2019 and 11,678 t used in place of maximum permissible ABC for 2020 and 2021. The final catch for 2019 was estimated by taking the average tons caught between October 19 and December 31 over the previous 5 years (2014-2018) and adding this average amount to the catch-to-date as of October 19, 2019. The 2020 and 2021 catch was estimated as the average of the total catch in each of the last 5 years (2014-2018).

## Figures

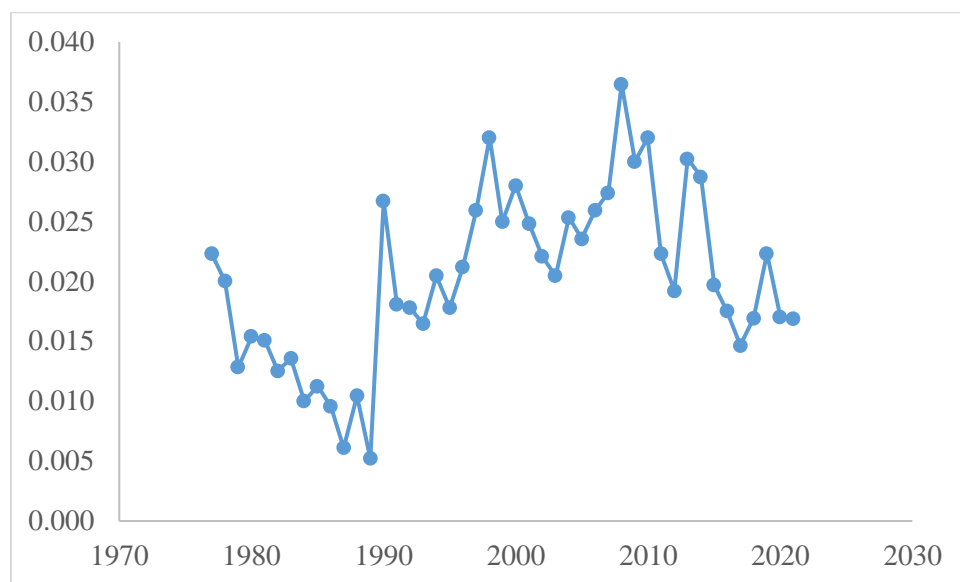


Figure 1. Total catch to total age 3+ biomass ratio for *Hippoglossoides* species in the Bering Sea and Aleutian Islands, including projected catch and biomass through 2021.

## Tables

Table 1. EBS Shelf (standard area) and Aleutian Islands survey biomass and CV for flathead sole, Bering flounder, and the two combined (*Hippoglossoides spp.*)

Year	<i>Hippoglossoides spp.</i> EBS Only		EBS Flathead Sole Only		EBS Bering Flounder Only		Aleutian Islands (only Flathead Sole found)		EBS Bottom Temp (deg C)
	Bio.	CV	EBS	CV	Bio.	CV	Bio.	CV	
1982	192,037	0.09	192,037	0.09					2.27
1983	270,972	0.10	252,612	0.11	18,359	0.20	1,213	0.20	3.02
1984	285,849	0.08	270,794	0.09	15,054	0.22			2.33
1985	265,428	0.07	252,046	0.08	13,382	0.12			2.37
1986	357,963	0.09	344,002	0.09	13,962	0.17	5,245	0.16	1.86
1987	393,588	0.09	379,394	0.10	14,194	0.14			3.22
1988	561,868	0.09	538,770	0.09	23,098	0.22			2.36
1989	521,140	0.08	502,310	0.09	18,830	0.20			2.97
1990	593,504	0.09	574,174	0.09	19,331	0.15			2.45
1991	546,010	0.08	518,380	0.08	27,630	0.22	6,939	0.20	2.70
1992	618,338	0.11	603,140	0.11	15,198	0.21			2.01
1993	607,724	0.07	585,400	0.07	22,324	0.21			3.06
1994	690,153	0.07	664,396	0.07	25,757	0.19	9,935	0.23	1.57
1995	594,421	0.09	578,945	0.09	15,476	0.18			1.74
1996	616,460	0.09	604,427	0.09	12,034	0.20			3.42
1997	783,909	0.21	769,783	0.22	14,126	0.19	11,554	0.24	2.74
1998	683,627	0.20	675,766	0.21	7,861	0.21			3.27
1999	401,194	0.09	387,995	0.09	13,199	0.18			0.83
2000	392,817	0.09	384,592	0.09	8,225	0.19	8,906	0.23	2.16
2001	515,362	0.10	503,943	0.11	11,419	0.21			2.58
2002	553,333	0.18	548,401	0.18	4,932	0.19	9,898	0.24	3.25
2003	514,868	0.10	509,156	0.11	5,712	0.21			3.81
2004	612,289	0.09	604,186	0.09	8,103	0.31	13,298	0.14	3.39
2005	612,467	0.09	605,350	0.09	7,116	0.28			3.47
2006	635,283	0.09	621,390	0.09	13,893	0.32	9,665	0.18	1.87
2007	562,568	0.09	552,114	0.09	10,453	0.22			1.79
2008	545,470	0.14	535,359	0.15	10,111	0.19			1.29
2009	418,812	0.12	412,163	0.12	6,649	0.17			1.38
2010	495,235	0.15	488,626	0.15	6,610	0.16	11,812	0.31	1.53
2011	583,300	0.19	576,498	0.19	6,802	0.15			2.47
2012	381,477	0.12	374,842	0.12	6,635	0.14	5,566	0.15	1.01
2013	491,191	0.17	485,486	0.17	5,705	0.14			1.87
2014	519,450	0.14	509,801	0.14	9,649	0.18	13,436	0.14	3.22
2015	393,194	0.11	382,173	0.12	11,021	0.17			3.36
2016	446,300	0.07	433,469	0.07	12,831	0.24	6,759	0.15	4.46
2017	540,567	0.08	531,291	0.08	9,275	0.23			2.83
2018	488,415	0.08	484,890	0.08	3,524	0.16	6,930	0.12	4.26
2019	594,348	0.14	592,257	0.14	2,092	0.33			4.53

Table 2. Northern Bering Sea survey biomass and CV for flathead sole, Bering flounder, and the two combined (*Hippoglossoides spp.*).

Year	Flathead sole		Bering Flounder		<i>Hippoglossoides spp.</i>	
	Bio	CV	Bio	CV	Bio	CV
2010	-		12,355	0.17	12,355	0.17
2017	76	0.72	20,784	0.22	20,860	0.22
2019	463	0.34	18,526	0.19	18,989	0.19

Table 3. Catches of flathead sole and Bering flounder in the Bering Sea and Aleutian Islands

Year	Total ( <i>Hippo. spp.</i> )	Flathead sole	Bering Flounder	Year	Total ( <i>Hippo. spp.</i> )	Flathead sole	Bering Flounder
1964	12,315			1999	18,573	18,553	20
1965	3,449			2000	20,441	20,408	33
1966	5,086			2001	17,811	17,795	16
1967	11,218			2002	15,575	15,550	25
1968	12,606			2003	13,785	13,767	18
1969	9,610			2004	17,398	17,374	24
1970	21,050			2005	16,108	16,077	31
1971	26,108			2006	17,981	17,975	6
1972	10,380			2007	18,958	18,952	6
1973	17,715			2008	24,540	24,526	14
1974	13,198			2009	19,558	19,530	28
1975	5,011			2010	20,128	20,102	26
1976	7,565			2011	13,559	13,539	20
1977	7,909			2012	11,367	11,362	6
1978	13,864	13,734	130	2013	17,355	17,275	80
1979	6,042	6,042	0	2014	16,512	16,479	33
1980	8,600	8,026	574	2015	11,308	11,275	33
1981	10,609	10,599	10	2016	10,358	10,345	12
1982	8,417	8,397	20	2017	9,150	9,147	3
1983	5,518	5,509	9	2018	11,061	11,056	5
1984	4,458	4,395	63	2019*	14,096	14,095	1
1985	5,636	5,626	10				
1986	5,208	5,146	62				
1987	3,595	3,479	116				
1988	6,783	6,697	86				
1989	3,604	3,594	10				
1990	20,245	19,264	981				
1991	14,197	14,176	21				
1992	14,407	14,347	60				
1993	13,574	13,463	111				
1994	17,006	16,987	19				
1995	14,715	14,710	4				
1996	17,346	17,341	5				
1997	20,683	20,678	5				
1998	24,387	24,381	7				

\* Catch as of October 19, 2019

## **References**

McGilliard, C.R. ,Nichol, D., and Palsson, W. 2018. 9. Assessment of the Flathead Sole-Bering flounder Stock in the Bering Sea and Aleutian Islands. In Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska. 176p. North Pacific Fishery Management Council, P.O. Box 103136, Anchorage AK 99510.